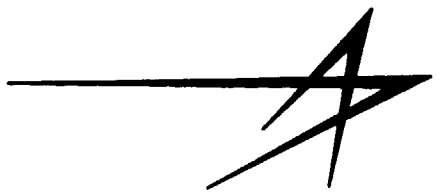

Critical Surface Cleaning and Verification Alternatives

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Critical Surface Cleaning and Verification Alternatives

Primary Goal:

Maintain qualified cleaning and verification processes with environmentally compliant materials that perform to specifications to assure continued successful processing of the critical hardware.

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Critical Surface Cleaning and Verification Alternatives

Scope:

Environmental regulations continue to impact cleaning and verification of component and large structures.

The scope of this project was to qualify a safe and environmentally compliant LOX surface verification alternative to Freon 113, TCE and HCFC 225. The main effort was focused on initiating the evaluation and qualification of HCFC 225G as an alternate flush LOX verification solvent.

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Critical Surface Cleaning and Verification Alternatives

Background:

HCFC 225G, is a cleaning solvent that is an environmentally compatible alternative for HCFC 225 in the areas of metal cleaning, vapor degreasing, and flushing. The major difference between HCFC 225 and HCFC 225G is that HCFC 225G is a single component (3,3-Dichloropentafluoropropane), while HCFC 225 is a two component system (3,3-Dichloropentafluoropropane and 1,3-Dichloropentafluoropropane).

By removing the 1,3 isomer HCFC 225G is less toxic than the HCFC 225 product. The respective Threshold Limit Values (TLV) are 250 ppm versus 25 ppm.

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Approach:

- Evaluate candidates for LOX mechanical impact sensitivity testing with liquid oxygen by the procedure outlined in NHB 8060/NASA STD-6001 Test 13 Part #1.
- Evaluate candidates materials of construction compatibility on hardware
- Evaluate candidates cleaning efficiency by applying three (3) common contaminants to ten (10) 2219 Al test panels.
- Perform Gravimetric analysis in order to determine the percent (%) removal cleaning efficiency for each of the respective contaminants.and candidate

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LOX Compatibility Test Results

MATERIAL	LOT	REACTIONS	RESULTS
HCFC 225G	59704211	0/20	PASSED
Freon 113	N/A	0/20	PASSED
HCFC 225	3114	0/20	PASSED
HFE 7100	N/A	0/20	PASSED

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Metallic Hardware Compatibility Evaluation

HARDWARE	STP METHOD	PROCESS
2219 T-87 Panel	5006 Method 1	Cleaned
2219 T-87 Panel	3001 Class 1A	Chem Film
2195 T-8M4 Panel	5006 Method 1	Cleaned
2195 T-8M4 Panel	3001 Class 1A	Chem Film
2195 to 2219 Welded Panel	5006 Method 1	Cleaned
2195 to 2219 Welded Panel	3001 Class 1A	Chem Film
Cres 304L	5007	Passivate
A-286	5007	Passivate
Cadmium Fasteners	N/A	N/A

The compatibility study consisted of submerging the hardware in HCFC 225G and/or Freon 113 (PCA) for thirty (30) days. No degradation or corrosion was observed for the respective metallic hardware tested with HCFC 225G or Freon 113 (PCA).

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Non-Metallic Hardware Compatibility Evaluation of HCFC 225G Per ASTM D543-87

Material	% Weight Change	Dimensions	Appearance.
Teflon	No Change	No Change	No Change
Viton	4.4 % Wt. Increase	Swelled	No Change

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Critical Surface Cleaning and Verification Alternatives

Project Accomplishments:

Replacement materials and processes have been identified for regulated and phased out solvents used in LOX Critical Surface Cleaning and Verification:

- TCE usage reduced by > 99%
- Methylene Chloride usage eliminated
- Freon PCA usage reduced by 95%

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Critical Surface Cleaning and Verification Alternatives

Project Accomplishments:

Replacement materials and processes have been identified for regulated and phased out solvents used in LOX Critical Surface Cleaning and Verification:

- TCE usage reduced by > 99%
- Methylene Chloride usage eliminated
- Freon PCA usage reduced by 95%

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Critical Surface Cleaning and Verification Alternatives

Average % Cleaning Efficiency of Ten Test Panels

Solvent	Safe-Tap	CRC 2-26	J-414
Freon 113	64.7	98.4	61.3
HCFC 225	96.6	91.8	31.5
HCFC 225G	106.0	101.0	75.2
	93.3*	98.4*	68.5*

*10 Test Panels Pre-Cleaned with HCFC 225G and Contaminated

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Critical Surface Cleaning and Verification Alternatives

Comparison of Other Solvents Average % Cleaning Efficiency

Solvent	Safe-Tap	CRC 2-26	J-414
Vertel MCA	54.6	88.6	58.8
HFE 7100DE	45.1	78.7	55.1
Freon 113	64.7	98.4	61.3
HCFC 225	96.6	91.8	31.5
HCFC 225G	93.3	98.4	68.5

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Critical Surface Cleaning and Verification Alternatives

Hardware Qualification:

HCFC 225G qualification consisted of cleaning hardware per Marshall Space Flight Center specification MSFC-SPEC-164B/C on the following items:

- 20 ft feedlines
- Clean Kits
- Tube Assemblies
- Mask Tool

The results to-date indicate HCFC 225G removed the contamination to an acceptable level of <1 mg/ft2, satisfying cleaning and verification requirement.

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Critical Surface Cleaning and Verification

Summary:

In summary HCFC 225G is an excellent cleaning and verification solvent for common industrial contaminates

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